SaskPower

Climate Change Action Plan

Progress Report 2002

Gold
Champion Level Reporter

103-05626/

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1 EXECUTIVE SUMMARY

SaskPower's 2002 Climate Change Action Plan Progress Report summarizes the results of our activities and initiatives in reducing greenhouse gas (GHG) emissions this past year. Since our 2001 Climate Change Action Plan Progress Report, we have made some revisions to our Voluntary Challenge and Registry (VCR) Inc. reporting methodology, intended to make our reporting more detailed and precise. SaskPower is committed to continually improving the quality and accuracy of the Progress Reports.

Assuming that SaskPower must reduce GHG emissions in compliance with the Kyoto Protocol to 6% below 1990 levels by 2008-2012, our climate change goal is to achieve 20% of our Kyoto gap by the end of 2003. This would result in a carbon dioxide (CO_2) reduction of approximately 1.3 million tonnes.

In the short term, SaskPower will have to rely on offsets to reduce GHG emissions. Until commercially viable technology is developed, the use of offsets will contribute to the need to preserve the integrity of the environment, while providing customers with cost effective electricity. To help achieve our climate change goal, SaskPower is actively involved with organizations that will help us develop policies, reduce emissions and research offset opportunities for the future. Organizations that we are currently involved with include the Canadian Electricity Association (CEA), the Greenhouse Gas Emission Reduction Trading (GERT) Pilot, and the Greenhouse Emissions Management Consortium (GEMCo). It is our continued involvement with organizations such as these that will allow SaskPower to build on our commitment in the years ahead.

In 2002, SaskPower reduced or offset GHG emissions by 606,000 tonnes of carbon dioxide equivalent (CO_2e). This compares with reductions or offsets of 571,000 tonnes in 2001. Total GHG emissions in 2002 were 13.8 million tonnes of CO_2e. SaskPower's thermal generation intensity was 1.09 kg CO_2e/kW.h in 2002, which is a reduction from the 1990 greenhouse gas intensity of 1.13 kg CO_2e/kW.h. Fossil fuel intensities have improved because of internal efficiency improvements and because natural gas use has increased relative to coal.

SaskPower's proactive GHG emission reduction activities in 2002 include:

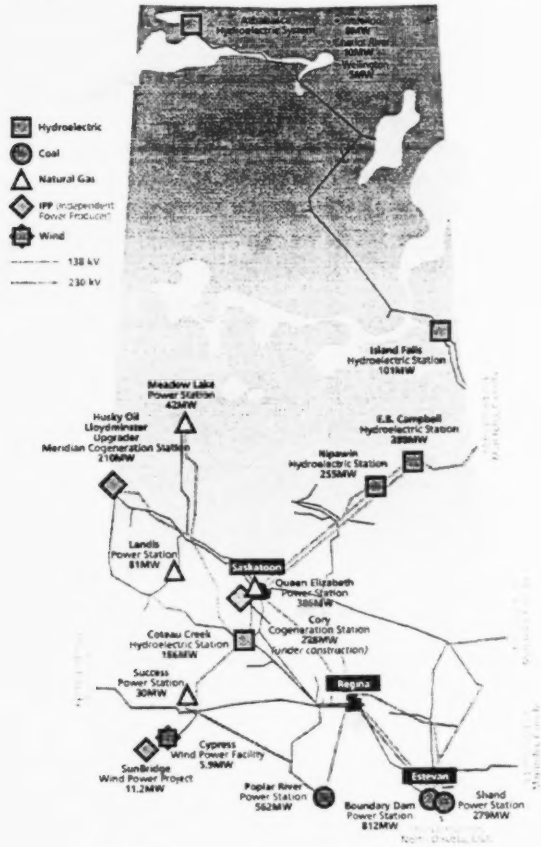
- exploring new offset opportunities through GEMCo
- purchase of 11.2 Megawatts (MW) of wind power from the SunBridge Wind Power Project
- installation of the 5.9 MW Cypress Wind Power Facility
- repowering of the Queen Elizabeth Power Station using combined-cycle technology
- development of alternative energy distributed generation projects, a combined heat and power project at the Regina General Hospital, and a flare gas capture project at an oil well site in Southern Saskatchewan.
- ongoing participation in the Canadian Clean Power Coalition (CCPC)
- continued support for the University of Regina's International Test Centre for Carbon Dioxide Capture, including a demonstration project at the Boundary Dam Power Station
- improving the efficiency of our thermal generation and hydroelectric generation stations

Actions such as these help SaskPower find new ways to reduce our GHG emissions and maintain our commitment to protect the environment while providing our customers with safe, reliable and cost-effective sources of electricity. We remain focused on achieving GHG reductions that will allow us to reach our climate change goal.

2 ORGANIZATION PROFILE

SaskPower was created as the Saskatchewan Power Commission in 1929 with the mandate to deliver safe, reliable and cost-effective power to the residents of Saskatchewan. SaskPower was incorporated as a provincial Crown corporation in 1950, and is governed by the Power Corporation Act of Saskatchewan.

SaskPower operates three coal fired power stations, seven hydro electric stations, four natural gas stations and nine wind turbines with aggregate generating capacity of 3,051 megawatts (MW), and has 221 MW of contracted capacity. SaskPower maintains more than 152,000 kilometers of power lines. SaskPower is committed to operating in a manner that helps protect the environment today and for future generations. To act on this commitment, SaskPower provides sound planning and training to ensure that we meet environmental laws and regulations, and that our employees are aware of these laws and regulations. To help minimize the impact of our operations on the environment, SaskPower is involved in a range of initiatives, such as implementing an ISO 14001-compliant environmental management system, growing and distributing tree seedlings through our SaskPower Shand Greenhouse, and continuously upgrading the environmental performance of our generating stations.



3 SENIOR MANAGEMENT SUPPORT

3.1 Signed Statement of Endorsement

On behalf of SaskPower, I am pleased to submit our 2002 progress report to the Voluntary Challenge and Registry (VCR) Inc. This report reflects SaskPower's ongoing commitment to the principles and objectives of the VCR Inc. program as we work to balance Saskatchewan's energy needs with a sustainable environment.

In December 2002 the Government of Canada ratified the Kyoto Protocol. The challenges that this decision will present to SaskPower are not yet known, however in preparation for the possible implications of the domestic implementation of the Kyoto Protocol, SaskPower has been proactive in four key areas: increasing effectiveness through internal initiatives and cogeneration projects; increasing customer awareness; investing in renewable energy sources; and pursuing offset opportunities which compensate for emissions.

In 2002 we reduced or offset in excess of 606,000 tonnes of GHG emissions. We have achieved these reductions by undertaken a broad base of activities, both internally and with our business and community partners, in support of our commitment to voluntary action. We continue to be diligent in our efforts to achieve the highest standards of reporting, to ensure that our results are accurate and verifiable.

The year 2002 is also very notable because the forest sequestration project that SaskPower initiated in partnership with Saskatchewan Environment in 1999 was endorsed by the Greenhouse Emission Reduction Trading (GERT) Pilot. A Canadian first, the project will offset 22 million tonnes of greenhouse gas emissions in Saskatchewan by establishing more than 500,000 hectares of forest carbon reserves and the planting of 5 million tree seedlings.

Climate change is a complex, challenging issue – for our industry, our nation and the global community. At SaskPower, our employees remain committed to taking a lead role in developing solutions that will benefit the generations to come.

John Wright

President & CEO

SaskPower

3.2 Internal Practices and Management Systems Dealing with Climate Change

The United Nations has declared climate change as a serious issue with a wide range of impacts. SaskPower recognizes the magnitude of this issue for the environment and our business operations, which is why we are undertaking actions that will help reduce emissions and educate employees and the public about climate change issues. We are looking to the future for new energy-efficiency and GHG-offset projects to decrease our emissions and discover additional reductions.

SaskPower was the first Canadian electric utility to achieve corporate wide registration under the ISO 14001 standard, and an external audit in 2002 verified that our environmental management system (EMS) continues to meet these demanding requirements. The EMS allows SaskPower to better control the environmental aspects of our business, while ensuring that we comply with all applicable environmental laws and regulations.

Regular reporting to senior management is another method of ensuring that SaskPower is making progress toward our climate change goal. Results are reviewed to ensure we are on target to reach our goal and to see if any changes or improvements can be made that will allow us to achieve better results in the future.

4 BASE YEAR QUANTIFICATION

4.1 Methodology

SaskPower's GHG emissions consist of approximately 99.2% CO_2, 0.7% N_2O, and small amounts of CH_4. CO_2 is used as the standard unit of measurement for emissions, since it is the primary GHG in the electrical industry. GHG are converted to a CO_2 equivalent (CO_2e) using the following global warming potentials (GWP): $CO_2 = 1$, $CH_4 = 21$ and $N_2O = 310$. It is worth noting that the GWP were updated by the Intergovernmental Panel on Climate Change (IPCC) in 2001, however the new emission factors have not yet been adopted by Environment Canada.

SaskPower's 1990 baseline emissions totals were not adjusted even though the baseline year was not representative of typical company operations. In 1990 SaskPower experienced very favourable hydro conditions, which resulted in less thermal production and below average emission levels.

SaskPower calculates CO_2 emissions from thermal generating stations based on two methods. For coal units the actual gross generation times measured heat rate is used to calculate the heat input from coal. An emission factor based on coal composition is then applied to calculate CO_2. This provides a much more accurate measure of heat input than a fuel volume based consumption method. The calculations are done separately for each of the nine coal units because heat rate varies significantly between units.

This year we converted the calculations for natural gas fired units from the heat rate method to a volume based calculation because natural gas volumes, and associated heat input, are accurately measured. Annual natural gas volumes dating back to 1990 were obtained so the calculations are consistent for all years. CH_4 and N_2O emissions are calculated on a similar basis using standard global warming potential factors.

All emissions factors used to perform emission estimates and calculations for buildings and vehicles are provided by the VCR Inc. Challenge Registry Guide to Entity and Facility Based Reporting.

SaskPower's VCR Inc. submission includes the reporting of emissions produced by rural offices, service centres and other buildings used in our operations. Emissions from rural offices, head office, and service centres are calculated by multiplying the total natural gas consumption in a given year by the appropriate emissions factor. Emissions resulting from electricity consumption are not included in the emissions from buildings, as they are included in the generation emissions.

Emissions due to line losses in our transmission and distribution network are included in generation emissions and are not treated as a separate entry in the tables.

SaskPower is also reporting emissions from the injection of CO_2 into the cooling water at Boundary Dam Power Station. This program began in July 1991, with detailed record-keeping beginning in 1992. Records are complete to 1998, with the exception of 1994, where an estimate was used for the consumption figure. In 2001, the CO_2 emission calculation for this project was changed to better reflect actual practice. Previous to 2001, CO_2 emissions for this project were equal to CO_2 consumption. However, in 2001 it was noted that only an approximate 50% of CO_2 injected into the water is emitted into the atmosphere. The cooling water absorbs the other 50% of CO_2. All years were recalculated using this methodology.

In an effort to track all possible emission sources, SaskPower has began estimating the GHG emissions that result from the use of the Lime Limestone Injection into the Furnace and reActivation of Calcium (LIFAC) system at Shand Power Station.

In accordance with the updated VCR Inc. Champion Level Reporting Checklist, SaskPower has incorporated indirect emissions that result from the purchase of electricity. Specifically these emissions pertain to a power purchase agreement with the 210 MW Meridian cogeneration plant and the purchase of electricity from the 228 MW Cory cogeneration plant. The liability for these emissions has not yet been determined however in accordance with the new reporting requirements, SaskPower has elected to incorporate all possible emission sources.

4.2 Quantification

See page 19.

5 PROJECTION

5.1 Methodology

Emissions forecasts for 2003 through 2007 were performed using the following methods:

- Plant emissions were calculated in the same manner as prior years, using estimated generation based on internal modelling, instead of actual generation;
- Vehicle emissions were calculated in the same manner as prior years;
- Annual vehicle fuel consumption was projected to increase by a small percentage;
- Purchased electricity emissions were based on existing contracts; and
- Natural gas consumption in SaskPower buildings was calculated in the same manner as prior years and projected to increase by a small percentage.

5.2 Quantification

This report contains GHG emissions projections through the year 2007. Current corporate budgeted estimates have been used in the calculations of future projections to ensure that they are as accurate as possible. The major sources of GHG emissions in SaskPower's operations result from our thermal power stations. Indirect sources of emissions for SaskPower include emissions from our fleet vehicles and buildings located throughout the province. SaskPower's direct and indirect emissions are composed of the three major GHG's: CO_2, CH_4 and N_2O.

6 TARGET SETTING

6.1 Targets

By developing a voluntary GHG emissions reduction target in 1999, SaskPower has demonstrated a commitment to target setting. This target allows SaskPower to monitor progress in reducing emissions and assess any further actions that may be necessary to reach the target. SaskPower's goal is to achieve 20% of our potential share of the Kyoto gap by the end of 2003. Our assumed Kyoto target is based on Canada's national target of 6% below 1990 levels for 2008-2012. In absolute terms, this translates into a target reduction of approximately 1.3 million tonnes by the end of 2003.

6.2 Process for Target Review and Update

The SaskPower Board of Directors established the target noted above. Progress towards meeting the target is updated through regular reports to management. It is anticipated that the SaskPower Board of Directors will be updating the target in summer 2003.

7 MEASURES TO ACHIEVE TARGETS

7.1 List of Key Activities/Projects

SaskPower is currently involved with a wide range of activities, both internally and with our business and community partners, that will generate emission reductions to reach our climate change goal. SaskPower is also exploring new opportunities for reductions in all areas of the corporation. Some projects are listed simply for informational purposes and do not result in any verifiable GHG reductions for SaskPower. Selected projects are discussed in the following section.

7.1.1 Consumer Initiatives

- Watson and Canora Energy Use Program

In partnership with other organizations, SaskPower tested various energy management concepts in the town of Watson and the district of Canora. The energy reduction measures consisted of water heater add-ons, residential light retrofits, and the use of timers to efficiently operate vehicle block heaters. The program resulted in energy savings of 58,000 kW.h per year.

CO_2 reduction: 50 tonnes/year since 1993

- Saskatchewan Building Energy Management Program

The Building Energy Management Program began in 1996 with start-up funds provided by SaskPower and SaskEnergy. The program involves auditing for possible energy and natural gas savings. Although SaskPower is no longer an active participant, the program continues to exist as a service of the Saskatchewan Research Council (SRC). The SRC operates and promotes the program throughout Saskatchewan.

- Ice Rink Energy Management Program

The Ice Rink Energy Management Program was initiated in 1995 with the intention of assisting municipal ice rinks with their operating costs by way of reducing energy consumption. SaskPower no longer participates in the program, but 163 rinks were audited during the period of our involvement, resulting in identifying potential energy savings of over 1.7 million kW.h/year.

- Health Care Energy Management

In 1994, SaskPower partnered with Natural Resources Canada, SaskEnergy, Saskatchewan Energy and Mines, and Saskatchewan Health to create a pilot project to identify potential energy savings in facilities in two Saskatchewan health districts. The project involved installation of energy-saving devices in the facilities and training of health-care staff in energy management.

- Energy Audits

Between 1990 and 1994, SaskPower offered an energy audit program to help industrial and commercial customers find potential energy savings in their operations. This program resulted in savings of approximately 29 million kW.h of energy and CO_2 reductions of 23,200 tonnes/year.

- SaskPower Energy Solutions

SaskPower Energy Solutions was created in 1999 to help customers optimize energy consumption. This is a demand-side management program with two main products: the Energy Performance Contracting (EPC) Solution and the Transformer Maintenance Solution. SaskPower has entered into an alliance with Honeywell Ltd. to offer EPC. The program has already identified energy savings for the Legislative Buildings in Regina, provincial buildings in Southern Saskatchewan, several rural school divisions and the City of Regina. A total of 70 government buildings and over 25 schools will complete energy saving retrofits in the next number of years. Significant reductions have already been realized in both electricity and natural gas consumption.

CO_2 reduction: 7,000 tonnes in 2002

- HomeCheck

HomeCheck is a component of our EnergyCheck initiative. The HomeCheck on-line audit application provides SaskPower and/or SaskEnergy customers to determine the electrical and natural gas costs of the major appliances and items in their home. Taking only five minutes to get results, a customer makes selections about their home, appliances, heating and cooling and other major electrical and natural gas items that are specific to their home. The program calculates monthly and yearly dollar amounts and GHG emissions specific to the household. The program provides dollar, kilowatt-hour, cubic meters of natural gas and greenhouse gas savings amounts associated with energy efficiency practices such as upgrading appliances to the most energy

efficient models available. Also, the customer is provided with saving tips about the items selected that will help them reduce their electrical and natural gas consumption and save money. Over 150 electrical and natural gas saving tips are available to the customer when all items in the program are selected. The saving tips provided also link to additional information on the topic. After the customer enters their account numbers, the program provides the customer's previous 12 months of electrical and natural gas consumption and associated greenhouse gas emissions. A set of energy charts allows customers to determine by percentages which group of appliances is using the most energy. In 2002, more than 3,200 on-line audits were completed, bringing the total to approximately 6,8000 since inception.

- Residential Energy Systems and Fundamentals of Electricity Directory

The Residential Energy Systems directory provides customers with information and facts on existing, new construction and outdoor energy systems. It also teaches customers about their home's energy use and provides energy saving tips. The Fundamentals of Electricity directory provides customers with the basics about electricity including facts, figures and definitions on a wide variety of topics including safety. It also includes a section "Frequently Asked Questions" related to electricity that customers might reference.

- EnerGuide for Houses

EnerGuide for Houses is a companion service to HomeCheck, SaskPower's on-line energy audit. A certified energy evaluator, using state-of-the-art technology, will visit a customer's home to assess the energy efficiency of the house and show the customer how to improve the comfort of their home, cut heating and cooling costs and ensure adequate, healthy ventilation.

The total value of an EnerGuide for Houses evaluation is $300. Natural Resources Canada (NRCan) contributes $150 and the cost to the customer is $150 plus GST. If the customer makes 2 referrals the evaluation is $100 plus GST.

If changes or upgrades are made based on the home evaluation report, a follow up evaluation is provided, at no charge, to measure the results. The complete program, as developed by NRCan, is supported in Saskatchewan by SaskPower and SaskEnergy, and delivered by the Sun Ridge Group.

- Appliance Cost Calculator

The Appliance Cost Calculator available as part of EnergyCheck, allows residential and farm customers to calculate the cost of running specific electrical appliances and equipment. The customer selects the appliance or equipment from the list given then enters the estimated monthly usage, and the calculator determines the monthly cost to operate that appliance or equipment. It is available on-line at www.saskpower.com and in brochure format. In the fall 2003 the Appliance Cost Calculator will include both electrical and natural gas appliances and equipment.

7.1.2 Transmission Line Projects

SaskPower is continuously involved with transmission line improvement projects. The largest of the past projects is the Condie/QE transmission line. The Condie/QE transmission line is a 230-kV line linking the Condie switching station near Regina and the Queen Elizabeth Power Station in Saskatoon. Completed in 1997, this line was designed to improve transmission reliability and efficiency between power stations in southern Saskatchewan and load areas in the north. As a

result of this transmission line, SaskPower saved an estimated 90 million kW.h of electricity in 2002 due to reduced line losses. The addition of the Cory generating station and Queen Elizabeth Power Station re-powering have reduced the benefits of the Condie/QE transmission line. However, the line loss savings on the line are highly dependent on generation dispatch and on tie line loading which is dependent on market conditions. The Condie/QE transmission line, in addition to several other transmission line improvement projects have contributed a significant amount of CO_2 reduction in 2002.

CO_2 reduction: 98,000tonnes in 2002

7.1.3 Generation Projects

SaskPower is undertaking numerous generation initiatives to improve performance from our generating units. The projects listed are changes from the design or operation of the plants as of 1990, which would not be considered regular maintenance. A description of all initiatives for the period from 1991 to 2007 follows, the associated reductions have been quantified and listed in Table 10.1.

The reductions from the two Saskatchewan wind power facilities are also listed however not for the purpose of retiring the reductions against SaskPower's emissions. The reductions are listed for the purposes of recording the positive environmental impact of the SaskPower GreenPower product.

CO_2 reduction: 419,700 tonnes in 2002

- Boundary Dam Boiler/Turbine Optimization

There are a number of initiatives underway to improve the quality of operation of the Boundary Dam boilers and turbines, which will improve heat rate through reduction of slagging and fouling, reduction in soot blowing losses, and improved boiler and turbine cycle efficiency. These initiatives include:

- fuel quality management
- improved soot blowing strategies
- fuel and air distribution system tuning
- on-line performance displays
- off-line boiler/economizer cleaning

The estimated heat rate improvement is in the order of 50 kJ/kWh for each unit. The CO_2 reduction was calculated assuming that the improvement in heat rate will occur over a 10 year period at the rate of 10% of the improvement per year.

An example of work completed in this area in 2002 was the implementation of the On-Line Performance monitoring system on Boundary Dam Units 1, 2, and 6.

- Water Lances for Boiler Cleaning on Boundary Dam Units 3 and 4

Water lances were installed on Boundary Dam Units 3 and 4 in 1992, to improve the cleanliness of boiler water walls and reduce the cycle heat rate losses resulting from high reheat spray flows.

- Addition of Economizer Surface to Boundary Dam Unit 5

Additional surface was added to the economizer of Boundary Dam Unit 5 in 1997. This increase in heat transfer surface resulted in a 130 kJ/kWh improvement in unit heat rate.

- Replacement of Estevan Generating Station

Estevan Generating Station was decommissioned in 1992, the same year that the Shand Power Station was commissioned. The CO_2 reductions resulting from the replacement of EGS were calculated by comparing the average heat rate of the coal fired fleet including EGS, and the heat rate of the coal fired fleet without EGS but including Shand.

- Boundary Dam Induced Draft Fans

Installation of electrostatic precipitators on Boundary Dam Units 3, 4 and 5, allows the use of more efficient airfoil type induced draft fans, and results in considerable reductions in fan power consumption. Airfoil induced draft fans were installed on Unit 4 in 1999, Unit 3 in 2000, and Unit 5 in 2002. The performance of the new fans has been verified through acceptance testing on all three units.

- Boundary Dam Unit 6 Turbine Upgrade

Major upgrades of the steam turbine are planned for Boundary Dam Unit 6 in 2003. These upgrades include the replacement of the rotor, blading, diaphragms, seals, and inner casing on the high and intermediate sections of the turbine, and the seals on the low pressure turbine. This upgrade makes use of advanced blade design technology and advanced steam seal technology, and will result in a 2.5% increase in the efficiency of the turbine.

- Boundary Dam Unit 6 Primary Air Heater Upgrades

The primary air heater baskets on Boundary Dam Unit 6 were upgraded in 2002, with higher performance baskets that allowed additional energy to be extracted from the flue gases. This upgrade resulted in a 0.5% increase in the efficiency of the boiler.

- Poplar River Unit 1 Precipitator Controls

Improvements to the electrostatic precipitator controls for Poplar River Unit 1 were completed in 2000, and power consumption for this equipment was reduced by an estimated 60%.

- Poplar River Unit 1 Boiler Upgrade

Upgrades to the boiler of Popular River Unit 1 were completed as part the major overhaul of this unit in 2001. This work included additional surface area in the superheater and economizer sections of the boiler and redesigned air heater baskets for improved heat recovery.

- Poplar River Unit 2 Boiler Improvements

Major boiler upgrade work on Poplar River Unit 2 turbine has been ongoing. This work includes improved air heater seals, improved economizer performance, mill tuning, burner retrofits, and on-line performance monitoring.

- Addition of Economizer Surface Area to Shand Unit 1

Surface area was added to the economizer of the Shand boiler, to reduce economizer gas outlet temperatures and improve boiler efficiency. This project was completed in 1995.

- Addition of Auxiliary Cooling Tower to Shand Unit 1

A new cooling tower was added to the Shand Power Station in 2000, to provide additional cooling capacity during the summer months and eliminate the summer derates of the unit resulting from high ambient wet bulb temperatures. This additional cooling capacity has the added benefit of increasing the efficiency of the turbine steam cycle. An estimate of the improvement in cycle efficiency was calculated using historical wet bulb temperatures, and cooling tower performance information recorded before and after the installation of the new tower. It was assumed that the new cooling tower would operate five months a year.

- Shand Boiler/Turbine Optimization

There are a number of initiatives underway to improve the quality of operation of the Shand boiler and turbine, which will improve heat rate through reduction of slagging and fouling, reduction in soot blowing losses, and improved boiler and turbine cycle efficiency. These initiatives include:

  - fuel quality management
  - improved soot blowing strategies
  - fuel and air distribution system tuning
  - on-line performance displays

A heat rate improvement of 25 kJ/kWh is expected from this work. Testing for coal pipe flow balancing continued in 2002, and the on-line performance monitoring system was implemented in 2002.

- Queen Elizabeth Power Station Unit 1 Repowering

Six new gas turbines were installed at the Queen Elizabeth Power Station and commissioned in 2002. The gas turbines are rated to produce 25 MW each and the exhaust from these turbines, passes through heat recovery steam generators which supply steam to the Unit #1 or Unit #2 steam turbines. The net combined cycle efficiency for the gas and steam turbines is about about 41%, while the conventional cycle efficiency of the existing gas fired boilers and steam turbines is only about 28%. The current generations plans indicates that energy generated through the combined cycle will displace a significant amount of the energy previously generated through the less efficient conventional operation of QE Units #1, #2, and #3. The CO_2 reduction was calculated as the product of the heat rate improvement resulting from the combined cycle, and the reduction in generation expected from the conventional cycle.

- Landis Efficiency and Capacity Improvements

The Landis gas turbine was upgraded in 1999 to increase both capacity and efficiency. The reduction in CO_2 was calculated from the improvement in turbine heat rate, the capacity of the turbine before the upgrade, and the average capacity factor from 1991 to 2010.

- Island Falls Units 1, 2 and 3 Runner and Transformer Upgrades

The capacity increases resulting from runner and transformer upgrades will result in reduced spilling of water and increased MWh of generation from these units, which will then replace other forms of generation. The additional hydro production was assumed to displace CO_2 production at the rate of 0.8 kg/kWh.

- Coal Plant Condenser Cleanliness

The efficiency of the turbine steam cycle depends upon proper cooling of the condenser, and this depends upon clean heat transfer surfaces. A number of initiatives have been undertaken to improve condenser cleanliness including, condenser performance monitoring, chemical cleaning procedures, ball cleaning systems, and CO_2 injection for scaling control on certain units. These initiatives have resulted in an estimated average improvement in heat rate of 75 kJ/kWh. The CO_2 reductions were calculated assuming that the improvements in condenser cleanliness occurred progressively over a 10 year period from 1990 to 2000.

- Cypress Wind Power Facility and Surplus SunBridge Wind Power

In 2002 SaskPower completed the construction of the 5.9 MW Cypress Wind Power Facility. The output of the nine wind turbines is currently being offered to Saskatchewan customers as Eco-Logo certified GreenPower, a registered trademark of Environment Canada's Environmental Choice Program. GreenPower consists of two valuable components – electricity and environmental benefit. Customers are made aware their purchase price has been discounted to reflect the value of the environmental benefit. The environmental benefit is held by SaskPower and transfered to customers or retired on their behalf. The environmental benefits are not retired against SaskPower's emissions.

The 11.2 MW SunBridge Wind Power Project is a partnership formed by Suncor Energy Inc. and Enbridge Inc. SaskPower is purchasing the wind-generated electricity for sale to the Government of Canada and other customers in Saskatchewan. The majority of the CO_2 reductions realized from this project are transferred to the Government of Canada for retirement. The surplus electricity is resold as part of the SaskPower EcoLogo certified GreenPower product. The environmental benefit is held by SaskPower and either transferred to customers or retired on their behalf. The environmental benefits are not retired against SaskPower's emissions.

The calculation of CO_2 reductions for both facilities is based on hourly monitoring and displacement of the marginal electricity supply at that time.

CO_2 reduction: 19,100 tonnes in 2002

- Alternative Energy Distributed Generation Projects

SaskPower is currently exploring the viability and reliability of providing alternative forms of power generation in Saskatchewan. This initiative is being developed in collaboration with other partners, including working jointly with SaskPower customers.

The alternative energy distributed generation projects, involve solar, wind, cogeneration, flare gas and biomass. These are small scale generation projects typically under one megawatt in size and located close to the load it serves. Projects completed to date include a microturbine cogeneration project at the Regina General Hospital; a flare gas project, capturing gas that is normally flared from oil well sites, to drive two microturbines; and finally a small scale solar project at the Saskatchewan Science center. Additional projects will be developed in 2003.

7.1.4 Other Projects

- Zero Garbage (Zero G) Recycling Program

SaskPower has operated the Zero G program since 1993, incorporating offices, generating stations, and transmission and distribution facilities throughout Saskatchewan. Regular waste audits are conducted to measure the volume and types of materials recycled in this program, and

to track recycling patterns in our facilities. As in previous years, employees at SaskPower have shown in 2002 their commitment to environmental responsibility by choosing to recycle over 60,000 kg of paper from our head office in Regina. Since the program was initiated, SaskPower has recycled approximately 617 tonnes of paper. The Zero G program decreases the amount of waste sent to landfills throughout the province, thereby reducing landfill gases, reducing energy use in paper production, and reducing the need for additional tree harvesting for paper production.

CO_2 reduction: 50 tonnes in 2002

- Head Office Building Upgrade

During 1996 and 1997, the exterior of SaskPower's head office in Regina underwent a number of energy-saving improvements. This project continues to save on natural gas consumption.

CO_2 reduction: 150 tonnes/year

7.2 Estimated Impact of Activities/Projects

Table 10.1 provides a complete listing of the estimated GHG emission impact of individual SaskPower projects for the period 1990-2007.

7.3 Research and Development

In pursuit of technological solutions to mitigate GHG emissions, SaskPower is currently taking part in several collaborative research initiatives aimed at the development of clean coal technology.

- Canadian Clean Power Coalition (CCPC)

The CCPC is an industry/government collaborative whose objective is to secure a future for the use of coal to generate electricity. The CCPC is conducting a three-year feasibility study (concluding in mid 2003) to evaluate and select an appropriate CO_2 removal technology followed by commercial demonstrations for a retrofit plant (by 2007) and new plant situations (by 2010). The potential exists for SaskPower to be the host for one of the demonstration projects. As a founding member, SaskPower is providing $238,000 toward the development of expertise that will virtually eliminate air emissions of concern, including carbon dioxide, from coal burning power plants.

- CANMET CO_2 Consortium

CANMET, a division of NRCan, has been conducting pilot scale research work on a CO_2/O_2 recycle combustion concept. The concept will reduce the emissions of CO_2 as well as other emissions from power plants. Preliminary cost estimates indicate this technology would be competitive with amine based approaches to capture CO_2 from existing power plants.

- University of Regina International Test Centre for CO_2 Capture

The University of Regina has established the International Test Centre for CO_2 Capture. Along with its CO_2 pilot plant at SaskPower's Boundary Dam Power Station and facilities on campus, the International Test Centre will investigate methods to reduce the cost of using solvents such as amines to capture CO_2 from flue gases. SaskPower is providing $300,000 in support of the Centre.

- Weyburn CO_2 Monitoring

EnCana is injecting CO_2 into the Weyburn oilfield for enhanced oil recovery. SaskPower is involved in a project with the Petroleum Technology Research Centre to monitor the oilfield to determine the ultimate fate of the injected CO_2.

- Zero Emissions Coal Alliance (ZECA)

Several Canadian and American energy companies are participating in a long term project to develop a series of technologies which would result in the ability to use coal to generate electricity with no emissions, including CO_2. The ZECA technology is still in its infancy but is based on the production of hydrogen from coal.

- Gasification Users' Association (GUA)

SaskPower participates in the GUA being led by the Electric Power Research Institute (EPRI) in the United States. The objectives of the GUA are to supply technical and management services to its members, and to promote an interactive network of organizations with interests in the development and application of gasification and related technologies.

- Clean Coal Technology Roadmap (CCTRM)

SaskPower has a leadership role in the federal government's CCTRM initiative. The CCTRM is a planning tool to help industry predict the market's future technology and product needs related to the use of coal for electricity generation while virtually eliminating emissions.

- Prairie Soil Carbon Balance (PSCB) project

This is a past project to which SaskPower contributed through GEMCo. The PSCB project investigated the science of measuring, monitoring and verifying carbon sequestration in agricultural soil. Sustainable agricultural practices, such as minimal tillage and zero tillage, lead to increases in soil carbon sequestration potential. The potential for carbon sequestration in Saskatchewan's agricultural soils is significant.

8 RESULTS ACHIEVED

8.1 Current Reporting Year

SaskPower's 2002 GHG reductions and offsets totaled 606,000 tonnes of CO_2 e, which is significant progress towards SaskPower's reduction targets. The use of offsets is a very important part of SaskPower's mitigation strategy, but the strategy also continues to strive for further reductions in customer efficiencies and internal actions, including generation efficiency improvements. A detailed list of GHG reductions and offsets can be found in Table 10.1

8.2 Interim Years

See Table 10.1 for a complete listing of GHG reductions and offsets projects for the period 1990 through 2007.

8.3 Verification

SaskPower does not currently have its GHG reporting verified by an external third-party. However, any data used in performing current and past calculations is maintained on file for internal documentation and verification. Internal verification procedures include validation of calculations, figures, data and methodology used in this report.

8.4 Offsets

In the short term, offsets represent a significant part of SaskPower's GHG emission reduction strategy. An offset project mitigates or sequesters GHG outside the normal operations of SaskPower and our facilities. In 2002, SaskPower continued working toward finding and acquiring new GHG offset opportunities. Offsets may consist of emission reductions, emissions avoidance and carbon sequestration activities. Specific examples of offsets include:

- the preservation and enhancement of carbon stocks such as forests, wetlands and soils that may be in danger of disappearing;
- long-term disposal of GHG through geological storage;
- the control or capture of pollution, including the capture of landfill gas;
- the displacement of other emission sources, such as cement manufacture through the sale of flyash; and
- reducing fossil fuel consumption through the use of low-emissions technology.

SaskPower's goal is to fill 20% of the Kyoto gap by the end of 2003. For now, it is understood that SaskPower could be required to reduce emissions to 6% below 1990 levels for 2008-2012.

- Flyash Sales

Flyash is a fine powder by product of burned coal that can be extracted from exhaust gases, preventing release into the atmosphere. Flyash properties vary between power stations due to the composition of coal burned at each plant. As a cement extender, flyash can be used to make concrete blocks and pipes and ready-mix concrete. It is also used as a fill material in the mining and oil industries. In 2002, SaskPower International continued selling flyash to a Saskatchewan based company involved in a provincial highway improvement project that involves blending flyash with other materials to strengthen thin membrane surfaced roads commonly referred to as secondary highways, across the province. In 2002, SaskPower International sold 57,300 tonnes of flyash, and sales are projected to increase to over 88,000 tonnes by 2007.

CO_2 offset: 29,000 tonnes in 2002

- Old Man on His Back Short Grass Prairie and Heritage Preserve

In 1996, SaskPower entered into a partnership with the Nature Conservancy of Canada to create a 13,100-acre prairie and heritage preserve. This preserve is one of the last short-grass prairie communities in the prairie provinces, and is home to a number of endangered species including the ferruginous hawk, burrowing owl, loggerhead shrike, and swift fox. The property also has significant heritage value because of cultural resources in the form of medicine wheels and pastures used by the North West Mounted Police. Grasslands and forests that are kept in a natural state capture carbon from the atmosphere and sequester it in the soil. This project will offset 500,000 tonnes of CO_2 over a 10-year period, beginning in 1996.

CO_2 offset: 50,000 tonnes/year from 1996 to 2005

- Forest Carbon Sequestration Agreement

In 2002 the forest sequestration project that SaskPower initiated with Saskatchewan Environment in 1999 was endorsed by the Greenhouse Emission Reduction Trading (GERT) Pilot. A Canadian first, the project will offset greenhouse gas emissions in Saskatchewan by establishing more than 500,000 hectares of forest carbon reserves and the planting of 5 million tree seedlings. The reserves and planted trees will sequester carbon from the atmosphere, allowing SaskPower to receive 22 million tonnes of carbon dioxide offset credits from the agreement.

CO_2 offset: 2,200,000 tonnes/year from 2003 to 2012

- Ducks Unlimited Canada

In 1996, SaskPower became the first Diamond Legacy sponsor of Ducks Unlimited (DU) Canada with the signing of a 30-year agreement. Each year, we make a contribution of $115,000 to DU programs in Saskatchewan in support of habitat, education and research programs. This year, we are supporting the development of interpretive sites at DU projects near Prince Albert, Melfort and Humboldt. We are also continuing to support *Wetlands are Wonderlands*, an innovative, hands on program that enables students and teachers to experience Saskatchewan's wetlands first hand. More than 15,000 children have participated in the program over the past three years. The climate related projects that were funded in the past number of years include a carbon sequestration study and a forest initiative seeking to provide baseline ecological data that can be used to detect large scale ecological changes due to a variety of causes, including climate change.

- SaskPower Shand Greenhouse

SaskPower Shand Greenhouse has been in operation since 1991, producing seedlings for distribution throughout Saskatchewan. The greenhouse draws excess heat from Shand Power Station to provide warmth during the winter for the propagation of trees, shrubs, and native plant species. In 2002, the greenhouse distributed in excess of 450,000 tree and shrub seedlings to organizations and individuals within the province. To date, over 3,000,000 seedlings have been grown and distributed. This is an important activity for SaskPower because as trees reach maturity, they sequester increasing amounts of carbon taken out of the atmosphere.

- GEMCo - Norseman Landfill Gas Project

The Greenhouse Emissions Management Consortium (GEMCo) is a not-for profit Canadian consortium formed by companies that wish to demonstrate industry leadership in developing voluntary and market-based approaches to GHG emissions management. SaskPower has been a GEMCo member since 1996 and is currently involved in a landfill gas capture project coordinated by Norseman Engineering in British Columbia. The project collects CH_4 from the Port Mann landfill in Surrey, BC and delivers it to a nearby wallboard plant where the gas is mixed with natural gas to heat burners that cure the wallboard. As a result of this project, SaskPower has access to 23,310 tonnes of CO_2 emission reduction credits over a 14-year period, which began in 2000. This process prevents the release of CH_4 into the atmosphere and reduces the wallboard plant's need for natural gas.

CO_2 offset: 1,665 tonnes/year from 2000 to 2013

- Other Offsets

SaskPower currently has several offset projects under development. Given the uncertainty surrounding domestic implementation of the Kyoto Protocol and potential credit for early action, SaskPower is focusing on projects that have benefits other than GHG offsets. Ancillary benefits may include additional environmental benefits or may involve other aspects of SaskPower's operations, such as distributed generation and use of renewable fuel sources. SaskPower is currently developing other projects that will allow us to reduce our net GHG emissions and contribute to environmental sustainability. Some of these projects are being developed through GEMCo.

9 EDUCATION, TRAINING AND AWARENESS

9.1 Our Corporate Response to the Climate Change Issue

Climate change is a very important subject for SaskPower and for all Canadians and it is likely that the ratification of the Kyoto Protocol will have a notable effect on SaskPower's business. As part of our environmental commitment, and in order to minimize the economic risks associated with the Kyoto Protocol, SaskPower is undertaking voluntary actions to reduce GHG emissions throughout its operations and by working hard to discover additional areas for achieving reductions. SaskPower is also currently exploring new offset opportunities that could aid in meeting future reduction targets.

To ensure our performance, SaskPower's registration with the ISO 14001-compliant EMS allows us to better control the environmental aspects of our business, while ensuring that we comply with all applicable environmental laws and regulations.

9.2 Climate Change and Our Employees

Since climate change affects SaskPower's business and the environment, it is important that our employees are informed about this issue. Employees are also informed on what actions SaskPower is undertaking to reduce emissions and meet future targets. We address our employees on climate change issues by way of our employee publication, HiLines, and our employee Intranet. We report on some of the actions that SaskPower is undertaking to reduce GHG emissions and how the climate change issue will affect our business operations now and in the future. Employees also have access to annual documents such as the Annual Report, the Environment Review, and the Climate Change Action Plan Progress Report, which discuss climate change issues. In past many SaskPower employees attended climate change workshops through the Action By Canadians (ABC) program. Furthermore every year since the program's inception, SaskPower has participated in the City of Regina's *Cool Down the City - Commuter Challenge*. The program, held during Environment Week, encourages employees in Regina workplaces to protect the climate by leaving their cars at home and finding a 'green' way to work, such as walking, running, cycling, inline skating, carpooling and taking public transit. SaskPower promotes the program to its employees and encourages participation through a weeklong contest. The results of this contest are well publicized and serve to show the scale of the impact that individual decisions can have on the quantity of GHG emissions.

In 2002 SaskPower encouraged its employees to participate in the EnerGuide for House program by further reducing the cost of the service to $50 per evaluation. In total 108 SaskPower employees took advantage of this special employee offer.

9.3 Climate Change and Our External Contacts

SaskPower has been active in promoting climate change issues within Saskatchewan and the Canadian electricity industry. SaskPower has participated in voluntary emissions reporting since the inception of VCR Inc. in 1995. As well, as a member of the Canadian Electricity Association (CEA), SaskPower is involved with an external education and awareness program through the Environmental Commitment and Responsibility (ECR) program. The ECR program requires members to improve environmental performance and allows participation with federal and provincial governments in public policy development and implementation. Through our commitment to regular reporting, SaskPower believes that we set a good example for other organizations within Saskatchewan and the electricity industry.

9.4 Our Public Education on Climate Change

SaskPower participates in public education on climate change issues in a variety of ways. For example, the public receives climate change information from SaskPower news releases, our website, SaskPower Energy and Environment Workbooks for schools, and publications such as the annual Climate Change Action Plan Progress Report, SaskPower Annual Report, and Environment Review.

The SaskPower Shand Greenhouse also takes a very active role in public education and outreach. In fact one of the roles of the SaskPower Shand Greenhouse is to assist SaskPower in educating the public about climate change. Educational messages to children are delivered through several programs. Each year, grade 5 students in the Estevan area participate in a half-day "Trees and Kids" program that teaches them about their local environment and issues such as climate change. In 2002, SaskPower Shand Greenhouse also developed an interactive electronic presentation and delivered it to grade 4, 5 and 6 students in 12 schools across the province. The Energy and Our Environment Presentation introduces children to concepts of electricity production and climate change. It describes SaskPower's efforts in meeting the climate change challenge and encourages children to take individual actions to mitigate the problem. The presentation complements SaskPower's Energy and Our Environment Workbooks, and includes a teacher's resource to help teachers learn more about the concepts involved. SaskPower Shand Greenhouse also sponsored an Energy and Our Environment poster contest that saw over 600 children illustrate their ideas for reducing greenhouse gases. Four winners from across the province received prizes for their winning entries.

In addition to children's programs, Shand Greenhouse provides messaging to the larger public through its tree and shrub distribution programs. In 2002, over 450,000 tree and shrub seedlings were provided to the public for environmental plantings. This distribution program is an important means of raising awareness of climate change with the public and at the same time providing a tangible way of helping to mitigate for it. Additional information on climate change is provided through SaskPower Shand Greenhouse's website, bi-annual newsletters, and tours of the facility.

In partnership with the Saskatchewan Instructional Development and Research Unit at the University of Regina, the Government of Canada and SaskEnergy, SaskPower is aiding the delivery of enhanced environmental education to classrooms in Saskatchewan. Climate Change Education Saskatchewan focuses primarily on conducting teacher education workshops and developing and adapting instructional materials for use in Saskatchewan elementary and high schools.

10 CLIMATE CHANGE SUMMARY TABLES

10.1 Greenhouse Gas Reductions and Offsets

10.2 Greenhouse Gas Emissions

Table 10.1 Greenhouse Gas Reductions and Offsets

SaskPower

Greenhouse Gas Reductions (tonnes of CO_2)

Internal Reductions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
													ESTIMATED				
Consumer Initiatives:																	
Watson/Canora				50	50	50	50	50	50	50	50	50	50	50	50	50	50
SaskPower Energy Solutions											3,000	7,000	7,000	7,000	7,000	7,000	7,000
Transmission Line Projects:																	
Condie/QE								87,200	87,200	96,000	96,000	96,000	72,000	48,000	48,000	48,000	48,000
Lloydminster/Ermine										13,760	13,760	8,000	8,000	8,000	8,000	8,000	8,000
Green Lake/Beauval										5,840	5,840	5,920	5,920	6,480	8,080	10,080	12,080
Prince Albert/La Ronge													4,960	4,960	4,960	4,960	4,960
Swift Current/Maple Creek												160	160	160	160	160	160
Peebles 230-138 kV transformer													4,000	8,000	8,000	8,000	8,000
Rural Lines						3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Generation Projects:																	
Boundary Dam Waterlance Addition			7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400
Boundary Dam Boiler/Turbine Optimization						2,500	5,000	7,600	10,100	12,600	15,100	17,600	20,200	22,700	25,200	25,200	25,200
Boundary Dam 5 Economizer Rebuild								1,900	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500
Boundary Dam Induced Draft Fans										1,400	7,100	11,300	12,500	16,000	16,000	16,000	16,000
Boundary Dam 6 Primary Air Heater													6,200	11,400	11,400	11,400	11,400
Boundary Dam 6 Turbine														24,600	49,100	49,100	49,100
Shand Replacement of Estevan GS			90,800	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600
Shand Economizer Addition						5,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500
Shand Auxiliary Cooling Tower											1,100	1,800	1,800	1,800	1,800	1,800	1,800
Shand Boiler/Turbine Optimization													1,500	3,100	4,600	4,600	4,600
Poplar River 1 Precipitator Controls											700	4,000	4,000	4,000	4,000	4,000	4,000
Poplar River 1&2 Boilers											7,500	13,200	17,900	17,900	17,900	17,900	17,900
Queen Elizabeth Unit 1 Repowering													33,800	69,900	69,900	69,900	69,900
Landis Efficiency and Capacity										1,700	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Island Falls 1-3 Turbine/Transformer									19,200	19,200	19,200	19,200	19,200	19,200	19,200	19,200	19,200
Coal Plant Condenser Cleanliness		8,100	16,100	24,200	32,200	40,300	48,400	56,400	64,500	72,500	80,600	80,600	80,600	80,600	80,600	80,600	80,600
150 MW Wind Power Project (100%)																14,800	73,500
Other Projects:																	
Recycling Program				50	50	50	50	50	50	50	50	40	50	50	50	50	50
Head Office Upgrade							150	150	150	150	150	150	150	150	150	150	150
Total Reductions:		**8,100**	**114,300**	**213,300**	**221,300**	**240,900**	**262,650**	**362,350**	**401,750**	**443,750**	**475,650**	**490,520**	**525,490**	**579,550**	**609,650**	**626,450**	**687,150**
External Offset Projects																	
Flyash Sales	10,000	9,750	9,600	8,750	13,500	16,500	18,000	31,500	31,800	22,900	22,700	28,700	28,700	32,700	35,500	39,800	43,100
Prairie Conservation							50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	
Norseman Landfill Gas											1,700	1,700	1,700	1,700	1,700	1,700	1,700
Forest Carbon Agreement														2,200,000	2,200,000	2,200,000	2,200,000
Total Offset Projects:	**10,000**	**9,750**	**9,600**	**8,750**	**13,500**	**16,500**	**68,000**	**81,500**	**81,800**	**72,900**	**74,400**	**80,400**	**80,400**	**2,284,400**	**2,287,200**	**2,291,500**	**2,244,800**

Table 10.1 Greenhouse Gas Reductions and Offsets

SaskPower

Greenhouse Gas Reductions (tonnes of CO_2)

											ESTIMATED						
Internal Reductions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Consumer Initiatives:																	
Watson/Canora				50	50	50	50	50	50	50	50	50	50	50	50	50	50
SaskPower Energy Solutions											3,000	7,000	7,000	7,000	7,000	7,000	7,000
Transmission Line Projects:																	
Condie/QE								87,200	87,200	96,000	96,000	96,000	72,000	48,000	48,000	48,000	48,000
Lloydminster/Ermine										13,760	13,760	8,000	8,000	8,000	8,000	8,000	8,000
Green Lake/Beauval										5,840	5,840	5,920	5,920	6,480	8,080	10,080	12,080
Prince Albert/La Ronge													4,960	4,960	4,960	4,960	4,960
Swift Current/Maple Creek												160	160	160	160	160	160
Peebles 230-138 kV transformer													4,000	8,000	8,000	8,000	8,000
Rural Lines						3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Generation Projects:																	
Boundary Dam Waterlance Addition			7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400	7,400
Boundary Dam Boiler/Turbine Optimization						2,500	5,000	7,600	10,100	12,600	15,100	17,600	20,200	22,700	25,200	25,200	25,200
Boundary Dam 5 Economizer Rebuild								1,900	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500
Boundary Dam Induced Draft Fans										1,400	7,100	11,300	12,500	16,000	16,000	16,000	16,000
Boundary Dam 6 Primary Air Heater													6,200	11,400	11,400	11,400	11,400
Boundary Dam 6 Turbine														24,600	49,100	49,100	49,100
Shand Replacement of Estevan GS			90,800	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600	181,600
Shand Economizer Addition						5,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500
Shand Auxiliary Cooling Tower											1,100	1,800	1,800	1,800	1,800	1,800	1,800
Shand Boiler/Turbine Optimization													1,500	3,100	4,600	4,600	4,600
Poplar River 1 Precipitator Controls											700	4,000	4,000	4,000	4,000	4,000	4,000
Poplar River 1&2 Boilers											7,500	13,200	17,900	17,900	17,900	17,900	17,900
Queen Elizabeth Unit 1 Repowering													33,800	69,900	69,900	69,900	69,900
Landis Efficiency and Capacity										1,700	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Island Falls 1-3 Turbine/Transformer									19,200	19,200	19,200	19,200	19,200	19,200	19,200	19,200	19,200
Coal Plant Condenser Cleanliness		8,100	16,100	24,200	32,200	40,300	48,400	56,400	64,500	72,500	80,600	80,600	80,600	80,600	80,600	80,600	80,600
150 MW Wind Power Project (100%)																14,800	73,500
Other Projects:																	
Recycling Program				50	50	50	50	50	50	50	50	40	50	50	50	50	50
Head Office Upgrade							150	150	150	150	150	150	150	150	150	150	150
Total Reductions:		**8,100**	**114,300**	**213,300**	**221,300**	**240,900**	**262,650**	**362,350**	**401,750**	**443,750**	**475,650**	**490,520**	**525,490**	**579,550**	**609,650**	**626,450**	**687,150**
External Offset Projects																	
Flyash Sales	10,000	9,750	9,600	8,750	13,500	16,500	18,000	31,500	31,800	22,900	22,700	28,700	28,700	32,700	35,500	39,800	43,100
Prairie Conservation							50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	
Norseman Landfill Gas											1,700	1,700	1,700	1,700	1,700	1,700	1,700
Forest Carbon Agreement														2,200,000	2,200,000	2,200,000	2,200,000
Total Offset Projects:	**10,000**	**9,750**	**9,600**	**8,750**	**13,500**	**16,500**	**68,000**	**81,500**	**81,800**	**72,900**	**74,400**	**80,400**	**80,400**	**2,284,400**	**2,287,200**	**2,291,500**	**2,244,800**

SaskPower

Greenhouse Gas Emissions (tonnes)

CO_2 Emissions (tonnes)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
													ESTIMATED				
Generation																	
Boundary Dam	4,006,100	5,048,600	5,320,700	5,144,200	5,814,900	5,909,500	5,888,400	5,944,200	6,081,200	6,175,700	6,180,500	6,484,100	6,401,800	6,116,500	6,399,500	6,544,200	6,358,900
Poplar River	4,602,000	4,560,600	4,732,300	4,394,800	4,426,200	4,519,400	4,398,700	4,639,500	4,667,900	4,464,000	4,527,500	4,406,900	4,492,900	4,624,000	4,653,900	4,287,700	4,640,100
Estevan	283,400	170,400	45,600														
Shand			857,700	2,008,200	2,228,800	2,065,900	2,247,400	2,284,400	2,231,600	2,288,900	2,042,800	2,201,200	2,149,100	2,288,500	2,302,100	2,248,100	2,296,700
Queen Elizabeth	172,300	182,600	394,600	245,200	281,500	271,700	276,000	540,000	635,500	591,100	535,600	455,300	563,100	434,300	517,500	735,400	690,300
Landis	22,100	7,200	21,900	15,500	13,600	20,900	35,400	58,400	101,100	41,000	67,700	90,300	68,200	14,100	18,400	48,800	49,600
Meadow Lake	17,200	34,700	84,600	33,200	29,900	50,500	70,600	65,500	145,800	87,900	52,000	24,200	300	6,300	8,300	15,400	23,100
Success	800	8,000	4,300	1,400	500	100	800	2,700	8,600	3,300	5,600	3,300	2,300	600	900	3,000	2,700
Northern Diesel[1]	1,800	1,700	200	200	500	200	200	300	200	300	300	400	400	300	400	400	400
Cory (50%)													9,600	224,900	248,500	270,800	268,300
Fleet Vehicles	11,900	11,600	12,400	12,000	12,100	12,500	11,500	10,500	10,100	10,500	10,500	10,600	13,300	11,400	11,400	11,400	11,400
Buildings	5,500	5,700	5,100	5,800	5,400	5,700	6,100	5,500	4,300	4,600	4,600	4,600	5,600	5,600	5,700	5,700	5,700
Total CO_2 Emissions:	**10,025,100**	**10,027,400**	**11,479,400**	**11,860,500**	**12,813,400**	**12,858,400**	**12,935,100**	**13,551,000**	**13,886,300**	**13,667,300**	**13,427,300**	**13,680,900**	**13,706,800**	**13,726,500**	**14,166,800**	**14,170,900**	**14,347,200**
Methane Emissions (kg)																	
Generation																	
Boundary Dam	73,100	75,200	79,200	76,600	86,600	88,000	87,700	88,500	90,600	92,000	92,000	96,600	95,300	91,100	95,300	97,500	94,700
Poplar River	68,500	67,900	70,500	65,500	65,900	67,300	65,500	69,100	69,500	66,500	67,400	65,600	66,900	68,900	69,300	63,900	69,100
Estevan	4,200	2,500	700														
Shand			12,800	29,800	33,000	30,600	33,300	33,900	33,100	33,900	30,200	32,600	31,800	33,900	34,100	33,300	34,000
Queen Elizabeth	2,900	3,100	7,300	4,300	5,000	4,800	4,900	10,000	12,100	11,300	10,300	8,800	10,800	8,100	9,700	13,700	12,900
Landis	400	100	400	300	200	400	600	1,100	1,900	800	1,300	1,700	1,300	300	300	900	900
Meadow Lake	300	600	1,600	600	500	900	1,300	1,200	2,800	1,700	1,000	500		100	200	300	400
Success	10	70	80	20	10		10	50	160	60	110	60	50	10	20	60	50
Northern Diesel[1]	150	150	10	10	50	20	20	20	20	30	30	30	40	30	30	30	30
Cory (50%)													200	4,200	4,600	5,100	5,000
Fleet Vehicles	1,200	1,100	1,200	1,100	1,100	1,100	1,000	900	800	800	700	600	700	700	700	700	700
Total Methane Emissions:	**150,770**	**150,730**	**173,790**	**178,230**	**192,360**	**193,120**	**194,330**	**264,770**	**210,960**	**207,090**	**203,040**	**208,490**	**207,090**	**207,340**	**214,250**	**215,490**	**217,780**
Total CO_2e : (tonnes)	**3,200**	**3,200**	**3,600**	**3,700**	**4,000**	**4,100**	**4,100**	**4,300**	**4,400**	**4,300**	**4,300**	**4,300**	**4,300**	**4,400**	**4,500**	**4,500**	**4,600**
Nitrous Oxide Emissions (kg)																	
Generation																	
Boundary Dam	114,800	118,100	124,500	120,400	136,100	138,300	137,800	139,100	142,300	144,500	144,600	151,700	149,800	143,100	149,800	153,100	148,800
Poplar River	107,700	106,700	110,800	102,900	103,600	105,800	102,900	108,600	109,200	104,500	106,000	103,100	105,200	108,200	108,900	100,400	108,600
Estevan	6,600	4,000	1,100														
Shand			20,100	46,800	51,900	48,100	52,400	53,200	52,000	53,300	47,500	51,200	50,000	53,200	53,500	52,300	53,400
Queen Elizabeth	800	1,000	5,400	1,700	2,700	3,000	2,800	9,900	14,600	13,600	12,400	10,500	13,000	9,700	11,600	16,500	15,500
Landis	400	100	400	300	200	400	600	1,100	2,300	900	1,600	2,100	1,600	300	400	1,100	1,100
Meadow Lake	300	600	1,500	600	500	900	1,200	1,200	3,300	2,000	1,200	600		100	200	300	500
Success	10	70	80	20	10		10	50	200	80	130	80	50	10	20	70	60
Northern Diesel[1]	250	240	20	20	80	30	30	40	20	50	50	50	60	50	50	50	50
Cory (50%)													200	5,000	5,600	6,100	6,000
Fleet Vehicles	1,000	1,000	1,000	1,000	1,000	1,000	900	800	700	700	700	600	700	700	700	700	700
Total Nitrous Oxide Emissions:	**231,860**	**231,810**	**264,900**	**273,740**	**296,090**	**297,530**	**295,640**	**313,990**	**324,620**	**319,630**	**314,180**	**319,930**	**320,610**	**320,360**	**330,770**	**330,620**	**334,710**
Total CO_2e : (tonnes)	**71,900**	**71,900**	**82,100**	**84,900**	**91,800**	**92,200**	**92,600**	**97,300**	**100,500**	**99,100**	**97,400**	**99,200**	**99,400**	**99,300**	**102,500**	**102,500**	**103,800**
Total CO_2e : (tonnes)	**10,100,200**	**10,102,500**	**11,565,100**	**11,949,100**	**12,909,200**	**12,952,700**	**13,031,800**	**13,652,800**	**13,991,300**	**13,770,700**	**13,529,000**	**13,784,400**	**13,810,300**	**13,830,200**	**14,273,600**	**14,277,900**	**14,455,900**

Notes: 1) Northern Diesel includes Brabant Lake and Southend (1990,1991) and Kinoosao (1990-Present)

2) CO2e: Greenhouse Gases expressed as an equivalent amount of CO_2, based on their Global Warming Potential CO_2=1, CH_4=21, N_2O=310

Table 10.2 Greenhouse Gas Emissions

SaskPower

Greenhouse Gas Emissions (tonnes)

													ESTIMATED			
CO_2 Emissions (tonnes)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Generation																	
Boundary Dam	4,908,100	5,048,900	5,320,700	5,144,200	5,814,900	5,909,500	5,868,400	5,944,200	6,081,200	6,175,700	6,180,500	6,484,100	6,401,800	6,116,500	6,399,500	6,544,200	6,358,900
Poplar River	4,602,000	4,560,600	4,732,300	4,394,800	4,426,200	4,519,400	4,398,700	4,639,500	4,667,900	4,464,000	4,527,500	4,406,900	4,492,900	4,624,000	4,653,900	4,287,700	4,640,100
Estevan	283,400	170,400	45,600														
Shand			857,700	2,008,200	2,228,800	2,065,900	2,247,400	2,284,400	2,231,600	2,288,900	2,042,800	2,201,200	2,149,100	2,288,500	2,302,100	2,248,100	2,296,700
Queen Elizabeth	172,300	182,600	394,600	245,200	281,500	271,700	276,000	540,000	635,500	591,100	535,800	455,300	583,100	434,300	517,500	735,400	690,300
Landis	22,100	7,200	21,900	15,500	13,600	20,900	35,400	58,400	101,100	41,000	67,700	90,300	68,200	14,100	18,400	48,800	49,600
Meadow Lake	17,200	34,700	84,600	33,200	29,900	50,500	70,600	65,500	145,800	87,900	52,000	24,200	300	6,300	8,300	15,400	23,100
Success	800	4,000	4,300	1,400	500	100	800	2,700	8,600	3,300	5,800	3,300	2,300	600	900	3,000	2,700
Northern Diesel[1]	1,800	1,700	200	200	500	200	200	300	200	300	300	400	400	300	400	400	400
Cory (50%)													9,600	224,900	248,500	270,800	268,300
Fleet Vehicles	11,900	11,600	12,400	12,000	12,100	12,500	11,500	10,500	10,100	10,500	10,500	10,600	13,300	11,400	11,400	11,400	11,400
Buildings	5,500	5,700	5,100	5,800	5,400	5,700	6,100	5,500	4,300	4,600	4,600	4,600	5,600	5,600	5,700	5,700	5,700
Total CO_2 Emissions:	**10,025,100**	**10,027,400**	**11,479,400**	**11,660,500**	**12,813,400**	**12,858,400**	**12,935,100**	**13,551,000**	**13,986,300**	**13,667,300**	**13,427,300**	**13,680,900**	**13,708,800**	**13,726,500**	**14,186,800**	**14,170,900**	**14,347,200**
Methane Emissions (kg)																	
Generation																	
Boundary Dam	73,100	75,200	79,200	76,600	86,600	88,000	87,700	88,500	90,600	92,000	92,000	96,600	95,300	91,100	95,300	97,500	94,700
Poplar River	66,500	67,900	70,500	65,500	65,900	67,300	65,500	69,100	69,500	66,500	67,400	65,600	66,900	68,900	69,300	63,900	69,100
Estevan	4,200	2,500	700														
Shand			12,800	29,800	33,000	30,600	33,300	33,900	33,100	33,900	30,200	32,600	31,800	33,900	34,100	33,300	34,000
Queen Elizabeth	2,900	3,100	7,300	4,300	5,000	4,800	4,900	10,000	12,100	11,300	10,300	8,800	10,800	8,100	9,700	13,700	12,900
Landis	400	100	400	300	200	400	600	1,100	1,900	800	1,300	1,700	1,300	300	300	900	900
Meadow Lake	300	600	1,600	600	500	900	1,300	1,200	2,800	1,700	1,000	500		100	200	300	400
Success	10	70	80	20	10		10	50	160	60	110	60	50	10	20	60	50
Northern Diesel[1]	160	160	10	10	50	20	20	20	20	30	30	30	40	30	30	30	30
Cory (50%)													200	4,200	4,600	5,100	5,000
Fleet Vehicles	1,200	1,100	1,200	1,100	1,100	1,100	1,000	900	800	800	700	600	700	700	700	700	700
Total Methane Emissions:	**150,770**	**150,730**	**173,790**	**178,230**	**192,360**	**193,120**	**194,330**	**204,770**	**210,980**	**207,090**	**203,040**	**208,490**	**207,960**	**207,340**	**214,250**	**215,490**	**217,780**
Total CO_2e : (tonnes)	**3,200**	**3,200**	**3,600**	**3,700**	**4,000**	**4,100**	**4,100**	**4,300**	**4,400**	**4,300**	**4,300**	**4,300**	**4,300**	**4,400**	**4,500**	**4,500**	**4,600**
Nitrous Oxide Emissions (kg)																	
Generation																	
Boundary Dam	114,800	118,100	124,500	120,400	136,100	138,300	137,800	139,100	142,300	144,500	144,600	151,700	149,800	143,100	149,800	153,100	148,800
Poplar River	107,700	106,700	110,800	102,900	103,600	105,800	102,900	106,800	109,200	104,500	106,000	103,100	105,200	108,200	108,900	100,400	108,600
Estevan	6,600	4,000	1,100														
Shand			20,100	46,800	51,900	48,100	52,400	53,200	52,000	53,300	47,500	51,200	50,000	53,200	53,500	52,300	53,400
Queen Elizabeth	800	1,000	5,400	1,700	2,700	3,000	2,800	9,900	14,600	13,600	12,400	10,500	13,000	9,700	11,600	16,500	15,500
Landis	400	100	400	300	200	400	600	1,100	2,300	900	1,600	2,100	1,600	300	400	1,100	1,100
Meadow Lake	300	600	1,500	600	500	900	1,200	1,200	3,300	2,000	1,200	600		100	200	300	500
Success	10	70	80	20	10		10	50	200	80	130	80	50	10	20	70	60
Northern Diesel[1]	250	240	20	20	80	30	30	40	20	50	50	50	60	50	50	50	50
Cory (50%)													200	5,000	5,600	6,100	6,000
Fleet Vehicles	1,000	1,000	1,000	1,000	1,000	1,000	900	800	700	700	700	600	700	700	700	700	700
Total Nitrous Oxide Emissions:	**231,860**	**231,810**	**264,900**	**273,740**	**296,090**	**297,530**	**299,640**	**313,990**	**324,620**	**319,630**	**314,180**	**319,930**	**320,810**	**326,360**	**330,770**	**330,620**	**334,710**
Total CO_2e : (tonnes)	**71,900**	**71,900**	**82,100**	**84,900**	**91,800**	**92,200**	**92,800**	**97,300**	**100,600**	**99,100**	**97,400**	**99,200**	**99,400**	**99,300**	**102,500**	**102,500**	**103,800**
Total CO_2e : (tonnes)	**10,100,200**	**10,102,500**	**11,565,150**	**11,949,100**	**12,909,200**	**12,952,700**	**13,031,800**	**13,652,800**	**13,991,300**	**13,770,700**	**13,529,000**	**13,784,400**	**13,810,300**	**13,830,200**	**14,273,800**	**14,277,900**	**14,455,600**

Notes: 1) Northern Diesel includes Brabant Lake and Southend (1990,1991) and Kinoosao (1990-Present)

2) CO2e: Greenhouse Gases expressed as an equivalent amount of CO_2, based on their Global Warming Potential: CO_2=1, CH_4=21, N_2O=310

GLOSSARY

Carbon dioxide equivalent (CO_2e)
A single unit of measurement used to calculate the impact of the various greenhouse gases. The conversion is based on the global warming potential of all greenhouse gases. $CO_2 = 1$, $CH_4 = 21$, $N_2O = 310$.

Cogeneration
The simultaneous generation of electricity and useful heat or steam.

Credit for early action
A system to credit verifiable early action prior to the first Kyoto Protocol commitment period as a further incentive to reduce GHG emissions.

Demand-side management (DSM)
Actions taken by a utility or other agency intended to influence the amount or timing of a customer's use of electricity.

Flyash
Residue left over when a fossil fuel such as coal is burned in a furnace.

Greenhouse gases (GHG)
Naturally-occurring gases such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) that trap heat in the earth's lower atmosphere.

Kilowatt hour (kW.h)
A unit of bulk energy. When a 100-watt bulb burns for 10 hours, it consumes one kilowatt-hour of energy.

Kyoto Protocol
An international agreement reached in December 1997 that sets legally binding targets for GHG emission reductions. Canada has agreed to reductions 6% below 1990 emissions levels for 2008-2012. The Government of Canada ratified the Kyoto Protocol in December 2002.

Line losses
Loss of energy in the power system due to resistance in the transmission and distribution wires.

Megawatt (MW)
A unit of bulk power, equals 1,000 kilowatts or 1 million watts. A watt is a unit for measuring electric power.

Offsets
Compensatory activities that reduce, avoid or sequester greenhouse gas emissions. The compensation must cause a net reduction in net atmospheric greenhouse gas concentrations, and usually takes the form of funding for projects which are outside the normal scope of operations for a company. Offsets are recognized by the Kyoto Protocol, and allow for the market to determine the least expense method to reduce greenhouse gas emissions while simultaneously maintaining environmental integrity.

Sequestration
The enhanced removal and storage of carbon from the atmosphere through biological processes. Carbon can be sequestered in different biomass, ranging from soil to trees.

Tonne (t)
Equals 1,000 kilograms.

To learn more about SaskPower's environmental programs and initiatives, please visit us on-line at saskpower.com or contact SaskPower Environmental Programs:

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